

**The genus *Limea* Bronn, 1831 in southern Africa
(Mollusca: Bivalvia: Limidae)**

by

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ABSTRACT

Three species of the genus *Limea* Bronn, 1831 (*s. l.*) occur in southern Africa. Two are described as new: the shallow-water *L. (Notolimea) drivasi*, which ranges from eastern Transkei north to the Mascarene Islands, and *L. (N.) crenocostata*, which is known only from the continental slope of western Transkei. The third species, *Limea (Isolimea) limopsis* (Nomura & Zinbo, 1934) was described from Japan, and is here recorded from the continental shelf of Zululand south to western Transkei.

INTRODUCTION

The genus *Limea* Bronn, 1831 (= *Limaea* Gray, 1847), in its broadest sense (eg. as utilised by Cox & Hertlein in Moore 1969), contains small limids characterised by possessing more or less distinct hinge teeth. However, as pointed out by Thiele (1934), two distinct groups of dentate limids can be distinguished: (a) *Limea s. s.* (including *Escalima* Iredale, 1929, and *Isolimea* Iredale, 1929) in which the teeth form a discrete small group on each auricular angle (Fig. 9), and (b) *Notolimea* Iredale, 1924 (= *Gemellima* Iredale, 1929) in which there is a long tooth series broken only at the ligament pit (Figs 3, 6). Although in the wider sense it is not unlikely that *Limea* is indeed polyphyletic, any conclusion must await detailed studies of hinge and other characters (such as prodissoconch sculpture and presence or absence of mantle tentacles) throughout the complex.

According to published literature, *Limea s. l.* is a small but almost cosmopolitan genus of perhaps 16–18 Recent species, none of which has been reported previously from southern Africa. However, sorting of bottom-samples from the Natal Museum dredging programme has brought to light specimens of three species. Of these, one is referable to subgenus *Isolimea*, and proves to be indistinguishable from a described Japanese species. The other two belong to subgenus *Notolimea*, but neither agrees with any described taxon, least of all any of the three species previously recorded from the Indian Ocean, namely *Limaea pectinata* H. Adams, 1870, from the Red Sea, *Lima (Limea) opulenta* Thiele, 1920, from off East Africa, and *Limaea juglandula* Melvill & Standen, 1907, from the Persian Gulf. (Although Thiele (1920) considered *Limatula ceylanica* A. Adams, 1863, from Ceylon also to be a *Limea*, examination of two syntypes (BM 1966720) confirms it to be a true *Limatula*).

As full data are available for very few extralimital congeners, I have not attempted diagnoses for the species described here.

ABBREVIATIONS

BM	= The Natural History Museum, London
d/h	= ratio of valve depth to height
l/h	= ratio of length to height
NM	= Natal Museum
NMDP	= Natal Museum Dredging Programme
NSMT	= National Science Museum, Tokyo

Family Limidae

Limea Bronn, 1831

Type species (by monotypy): *Ostrea strigilata* Brocchi, 1814, from the Miocene of Austria.

Key to southern African species

- 1 Valves barely oblique in outline; teeth extending along most of hinge plate; radial ribs bearing scales or concentric imbrications 2
- Valves markedly oblique in outline; teeth restricted to undersurface of auricles; ribs without scales or imbrications, intervals between ribs flat with a shallow groove on either side **limopsis**
- 2 Radial ribs rounded, crossed by rather widely-spaced concentric lamellae that form imbrications rather than scales or nodules on their crests; intervals between ribs without intermediary radials **crenocostata**
- Radial ribs angular, crossed by fine, closely packed, almost vertical lamellae, at intervals thickened into small transverse nodules; intervals between ribs each with 1–4 fine radial threads **drivasi**

Subgenus *Notolimea* Iredale, 1924

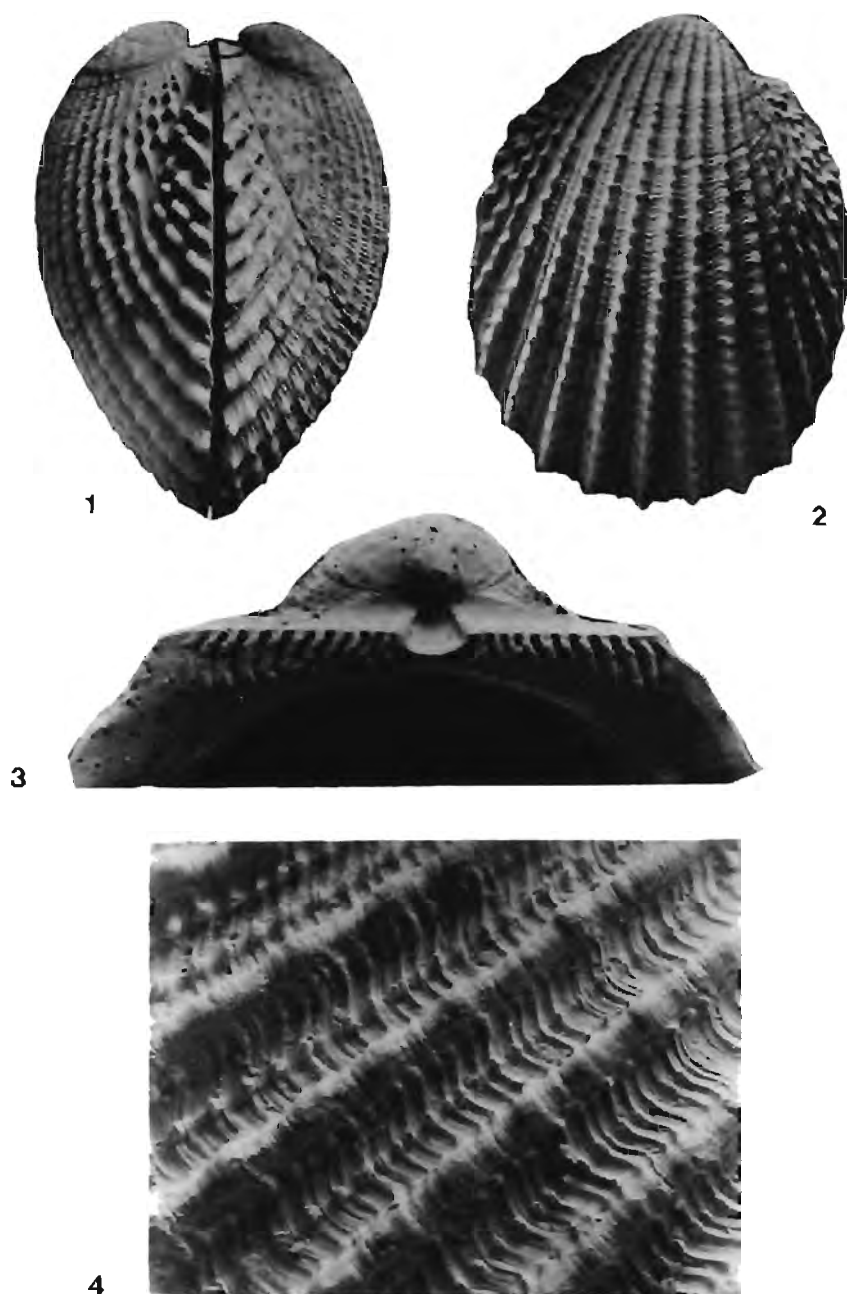
Type species (o. d.) *Lima australis* E. A. Smith, 1891

Diagnosis: Teeth numerous, extending most of length of hinge line; ligament pit median, small, not or scarcely arching hinge line; sculpture of strong, scaly ribs.

Limea (*Notolimea*) *drivasi* sp. n.

Figs 1–4

Description: Shell oblong-ovate, higher than long (l/h 0,74–0,80), almost equilateral, valves deep (d/h of single valve 0,32–0,41), thick, ends not gaping; sides equally convex in outline, auricles small, poorly differentiated and obtusely angled. Sculptured by 19–26 angular ribs, crossed by dense concentric threads, which at regular intervals are thickened into small transverse nodules, giving them a serrated profile in side view; ribs high on median face of valve, becoming progressively lower on anterior and posterior flanks, and near auricles are defined mainly by nodules; intervals between ribs equal to or slightly narrower than ribs themselves and bear 1–4 fine radial threads which are rendered granular by the (subequal) concentric threads; auricles with coarse, sometimes pliculate growth-lines. Interior with faint grooves formed by external ribs, whose intervals form a



Figs 1-4. *Limea (Notolimea) drivasi* sp. n. 1, Posterior view of holotype, NM E7341, dimensions $1,7 \times 2,1$ mm. 2, Exterior of paratype, NM E7335, left valve, dimensions $2,0 \times 2,6$ mm. 3, Hinge of left valve, paratype NM E7335. 4, External sculpture (Fig. 2) magnified, scale-line = $0,1$ mm. SEM.

series of 11–13 nodes on inner ventral margin, evanescent on anterior and posterior margins. Dorsal area symmetrically diamond-shaped (valves together), declivous, outer boundary demarcated by a low keel; ligament pit deep, triangular in each valve, median, higher than wide, barely opening at the hinge line. Hinge plate flattened and fairly broad, dorsal margin straight, ventral margin not or barely convex medially, width of plate crossed by 10–11 ridge-like teeth on either side, smooth medially in vicinity of ligament pit. Prodissoconch II ovate-trigonal, with 5 smooth ribs divaricating on either side of median. Entire shell white.

Dimensions: height 2,1 mm, length 1,7 mm, depth (two valves together) 1,4 mm (holotype); height 3,4 mm, length 2,5 mm (largest paratype valve).

Distribution: Continental shelf of eastern Transkei to Zululand, in 25–180 m (empty shells), and extralimally to Mauritius and Réunion Island.

Type material (presently all NM collection): Holotype, E7341/T194, off Gypsy Hill, Zululand (27°48,9'S; 32°38,4'E), 52 m, fine sand, NMDP, articulated shell. PARATYPES: ZULULAND: A5963/T200, off Kosi Bay, 50 m, ex CSIR Water Research bottom sample, 18 valves; E7335/T202, off Gypsy Hill, 52 m, fine sand, NMDP, 30 valves; B7197/T201, off Sodwana Bay, 100 m, ex CSIR Water Research bottom sample, 2 valves; E6909/T203, Leadsman Shoal, outer part, 25–28 m, dived D. Herbert and Natal Parks Board, 1 valve; E7334/T195, off Mission Rocks, 50 m, old coral rubble, lithothamnion, NMDP, 11 valves. NATAL: A7180/T196, off Cooper Lighthouse, Durban, 27 m, quartzite, broken shell, ex CSIR Water Research bottom sample, 1 valve. TRANSKEI: E7327/T198, off Mtamvuna River, 137 m, rocks, sponge, NMDP, 1 valve; E84/T199, off Port Grosvenor, 100–110 m, pebbles, some sand, NMDP, 1 valve; E7332/T197, off Mgazi River, 180 m, soft mud, NMDP, 1 valve. REUNION ISLAND: K5709/T204, off Saline les Bains, 50–75 m, J. Drivas, 15 valves, 1 articulated.

Other material: MAURITIUS: Grand Bay, beach-drift, two worn valves (NM K5360: J. Drivas).

Notes: The moderately broad, relatively strongly denticulate hinge (Fig. 3) indicates *Limea drivasi* to be referable to subgenus *Notolimea*. It is probably this species that was figured by Thiele (1920: figs 20–21) as an example of '*Lima (Limea) ceylanica*' from Dar es Salaam; as pointed out in my introduction, that species belongs to the genus *Limatula*. The hinge plate is much narrower than in the East African *Limea opulenta* (Thiele, 1920), the Red Sea *L. (N.) pectinata* (H. Adams, 1870), and the Farsian *L. (N.) juglandula* (Melvill & Standen, 1907); *drivasi* further differs from *opulenta* in its rib intervals bearing intermediary riblets, from *pectinata* (9 syntypes BM 1870.6.29.13 and 78.1.28.519) in its thinner main ribs, and from *juglandula* (6 syntype valves BM 1907.5.3.21–26) in its much narrower ribs and finer, differently shaped scales. *L. (N.) deliciosa* (Thiele, 1920), from unknown habitat, has stronger ribs with only concentric threads in the intervals. The type species of *Notolimea*, *L. australis* (E. A. Smith, 1891), from New South Wales, has closer, more scaly ribs with only incremental striae in the intervals. *L. torresiana* (E. A. Smith, 1885) from the Torres Straits, is probably the closest in sculpture to *drivasi*, but has broader, rounded ribs.

Externally there is some resemblance to the Japanese *Limatula* (*Notolimea*) *tosana* Oyama, 1943, which was accepted as a *Notolimea* by Habe (1977) and Kuroda & Habe (1981). However, according to the original description (kindly translated by Dr A. Matsukuma) *tosana* is higher (l/h 0,71) than *drivasi*, and its radial ribs appear to be closer, without intermediaries, and they bear 'spine-like scales'; hinge teeth are described as 'very minute' and the resilium as occupying one-fifth or more of the ligamental area (in *drivasi* it occupies about one-tenth). Pleistocene specimens from Kagoshima Prefecture, identified as *tosana*, and loaned by A. Matsukuma, lack hinge teeth, and are true *Limatula*.

Etymology: Named after Jean Drivas of Réunion Island.

***Limea* (*Notolimea*) *crenocostata* sp. n.**

Figs 5–6

Description: Shell oblong-ovate, slightly higher than long (l/h 0,76–0,84), very slightly oblique, posterior side more strongly convex than anterior, valves deep (d/h of single valve 0,30–0,35), thick, ends not gaping; auricles small, poorly differentiated and obtusely angled. Radial ribs low and numerous (about 27–35), becoming narrower and weaker towards auricles, crossed by thin, imbricate, concentric lamellae, which form raised scales mainly on flanks of valve and towards ventral margin, and on sides of valve may mask the radial sculpture; radial ribs rounded, with sloping sides and narrower, concave intervals, which totally lack intermediary sculpture. Interior with faint grooves formed by external ribs, whose intervals form a series of 10–14 nodes on inner ventral margin, evanescent on anterior and posterior margins. Dorsal area symmetrically diamond-



Fig. 5. *Limea* (*Notolimea*) *crenocostata* sp. n., exterior of holotype, NM E7331, dimensions $2,9 \times 2,4$ mm, left valve. SEM.

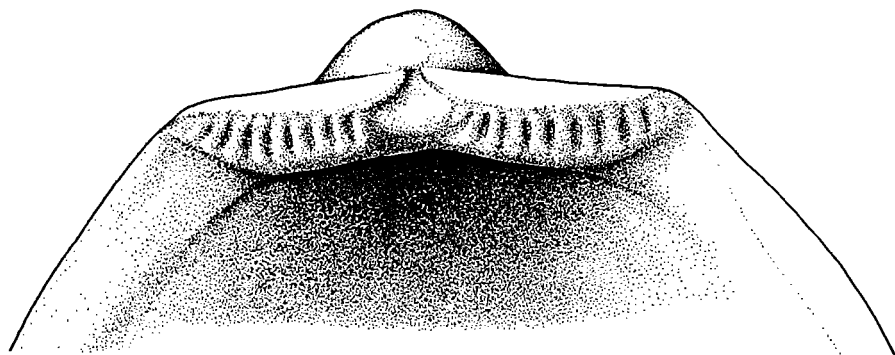


Fig. 6. *Limea* (*Notolimea*) *crenocostata* sp. n. Hinge of holotype.

shaped (valves together), moderately declivous, outer boundary demarcated by a low keel; ligament pit deep, equilaterally triangular in each valve, median, opening across hinge-line. Hinge plate flattened and broad, its dorsal margin straight, ventral margin shallowly concave medially, width of plate crossed by 7–12 ridge-like teeth on either side, with a smooth median gap. Prodissoconch II worn in types, evidently bearing strong growth-lines only. Entire shell white.

Dimensions: height 2,9 mm, length 2,4 mm, depth 1,0 mm (holotype); height 3,3 mm, length 2,5 mm, depth 1,0 mm (paratype).

Distribution: Known only from the slopes of the muddy Mzimvubu Bank, Transkei, in 180–300 m (loose valves).

Type material: Holotype NM E7331/T211, off Mgazi River (31°44,3'S; 29°32,2'E), 250 m, muddy sand, NMDP; one left valve. Paratype 1, NM E92/T212, off Mgazi River, 180 m, soft mud, NMDP, one left valve; paratypes 2–3, NM E9494/T13, do, 300 m, soft black mud, NMDP, two right valves.

Notes: Although only four single valves are available, *L. crenocostata* is easily distinguished from other southern African species by the crenulate concentric lamellae which conspicuously override the rather weak and numerous radial ribs, but are barely squamate (except for an occasional weakly scale-like expansion); the concave rib-intervals, which lack intermediary radial sculpture, are also characteristic. In the holotype the radial ribs continue to the auricles, which are rugosely sculptured, but in the paratypes the ribs evanesce laterally beneath the concentric sculpture, and the auricles are externally smooth.

Of extralimital species, external sculpture most resembles that of *Limea crassa* (Forbes, 1843) and *L. sarsii* (Loven, 1846) (if these two taxa are indeed distinct), from the north Atlantic and Mediterranean; the strong hinge-teeth of *crenocostata* (Fig. 6) readily distinguish it from these.

Subgenus *Isolimea* Iredale, 1929

Type species (o.d) *Limea parvula* Verco, 1908.

Diagnosis: Hinge teeth restricted to a short series below each auricle, ligament pit posterior to median, relatively large, causing hinge line to arch ventrally; radial ribs relatively widely spaced, without scales.

Limea (Isolimea) limopsis (Nomura & Zinbo, 1934)

Figs. 7–10

Lima (Limea) limopsis Nomura & Zinbo, 1934: 154, pl. 5, figs 11 a b, 12 a b. Type locality: Kikai-zima, Ryukyu Prefecture, Japan, early Pleistocene.

Limatula (Notolimea) limopsis; Oyama, 1943: 12, pl. 1, figs 4 a b, 5 a b.

Isolima [sic] limopsis; Masahito & Habe, 1976: 88, figs 4, 5; Kuroda & Habe, 1981: 79, pl. 5, fig. 6.

Description (local material): Shell obliquely oblong-ovate, slightly higher than long (l/h 0,88–0,97), valves deep (d/h of single valve 0,30–0,35), fairly thick, ends not gaping; anterodorsal margin almost straight, anteroventral end strongly rounded, posterodorsal margin shallowly concave below auricle, rest of posterior margin medially evenly convex; auricles small and obtuse, anterior one scarcely differentiated. Sculptured by 15–17 low, rounded ribs, in t/s with a slight median angle and gently sloping sides, crossed by growth-lines, which form a series of tiny scales or granules along both edges of each rib; each interval rendered superficially bisulcate by a very low, flat-topped intermediary rib (Fig. 10) which similarly bears pairs of granules (larger than those on main ribs), rendering intervals superficially rugose; ribs become weaker towards each end (where they become weakly granular), and evanesce on posterior and anterior faces, where they are replaced by strong growth-lines; intervals between ribs narrower than main ribs in width. Interior with distinct grooves formed by external ribs, whose intervals form a series of 12–15 nodes on inner ventral margin, evanescent on anterior and posterior margins. Dorsal area asymmetrically diamond-shaped (valves together), umbo situated just posterior to median, declivous, its outer boundary demarcated by a low keel; ligament pit moderately deep, situated below umbo, in each valve forming a triangle, wider than high, its ventral margin convex and projecting into interior. Hinge plate (Fig. 9) thin, expanded laterally below each auricle where it bears a group of 4–7 oblique, ridge-like teeth, hinge-line medially smooth. Prodissoconch II ovate-trigonal, smooth except for growth-lines. Entire shell white.

Dimensions: height 3,7 mm, length 3,4 mm (largest specimen).

Distribution: Western Transkei to northern Zululand (loose valves in 70–500 m), and extralimally to Japan.

Regional locality records: ZULULAND: off Dog Point, 70 m, sandstone rubble (NM E1996: NMDP); off Sodwana Bay, 100 m (NM A5813, E7343: CSIR Water Research bottom sample). TRANSKEI: off Mgazi River, 180 m, soft mud (NM E7333: NMDP); off Mgazi River, 250 m, muddy sand (NM E7330: NMDP); off Shixini Point, 500 m, muddy sand, coral rubble (NM E7329: NMDP).

Remarks: Local material has been compared with a sample from off Miyako Island, Okinawa (NSMT M51237), loaned by Dr. A. Matsukuma, and found to agree in all details. The previously known range of *L. limopsis* was given by Habe (1981) as 'Honshu (south to Kii Peninsula) to Ryukyu Islands'. The present record appears to be the first report of the subgenus *Isolimea* from the Indian Ocean. The other described species of the group are *L. parvula* (Verco, 1908) from South Australia, and *L. bronniiana* (Dall, 1886) of the tropical western Atlantic.



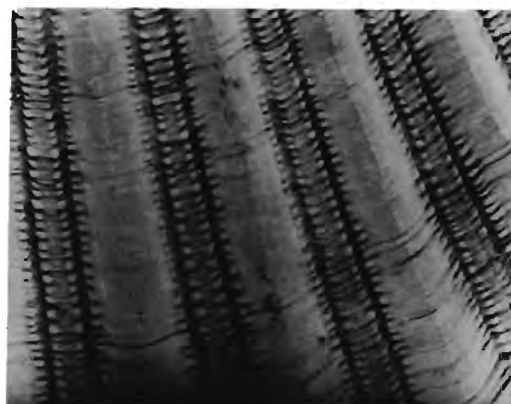
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9



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Figs 7-10. *Limea (Isolimea) limopsis* (Nomura & Zinbo, 1934). 7-8, Exterior and interior of right valve, NM E7343, off Sodwana Bay, 100 m, 3.4×3.1 mm. 9, Hinge of previous. 10, External sculpture magnified, scale-line 0.38 mm. S.E.M.

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